REMARKS

The Office Action mailed June 20, 2002 has been received and its contents carefully noted. In order to advance prosecution and obtain claim changes as a matter of right, a Request For Continued Examination and this Preliminary Amendment have been filed concurrently. In this Preliminary Amendment, claim 10 has been canceled, claims 9 and 11 have been amended, and the title has been replaced to reflect the amended claims.

Support for "multi-mode optical waveguide" in independent claim 9 is found in the Application as filed on page 11, line 9; page 15, line 18; page 16, line 9; page 24, line 24; page 26, lines 16-18; page 27, line 23; and page 28, line 25.

Support for "spin coating at about 1000 rpm" is found in the Application as filed on page 11, lines 13-15.

Applicants additionally wish to draw the Examiner's attention to the fact that Applicants consider that Embodiment 5 relates to a single-mode optical waveguide (see page 29, line 16, through page 32, line 19) and thus falls outside the scope of the invention as now claimed.

Claims 9 and 11 are now active in the Application and are believed to be in allowable condition. Claim 4 has been withdrawn as having been non-elected in responding to a restriction requirement. Should the Examiner find active claims 9 and 11 allowable, Applicants hereby authorize the Examiner to cancel non-elected claim 4, without disclaimer of the subject matter thereof and without prejudice to the filing of a Divisional Application directed thereto, in an Examiner's Amendment so that a Patent can issue for the allowed elected claims.

The rejection of claim 10 under 35 U.S.C. §112, first paragraph, is moot in view of cancellation of this claim.

The rejection of claim 9-11 under 35 U.S.C. §112, second paragraph, has been obviated by the amendment of claim 9.

The rejection of claims 5 and 6 [sic 9-11] under 35 U.S.C. §103 as being unpatentably obvious over Tsukamoto et al. (US 5,902,715) in view of Fan et al. (EP 0446672) is moot regarding cancelled claim 10 and is respectfully traversed regarding claims 9 and 11.

Applicants do not agree that the combined disclosures of Tsukamoto et al. and Fan et al. set out a *prima facie* case of obviousness against claims 9 and 11 because the combined disclosures do not meet Applicants' claims. Applicants' method for producing a multi-mode optical waveguide is submitted to be neither disclosed in nor suggested by any reasonable combination of the teachings of the applied references for the reasons which follow.

The present invention is a method for producing a multi-mode optical waveguide comprised of at least one core and a cladding having a refractive index which is lower than that of the at least one core. The method comprises the following five steps:

forming an under cladding layer onto a substrate;

preparing a mixture containing a reactive oligomer having general formula (I) and a photopolymerization initiator by blending, and controlling viscosity of the mixture to provide a viscosity mixture ranging from 500 cps to 10,000 cps by blending the reactive oligomer in an

amount ranging from 10 to 50 wt %, where R is C_mX_{2m+1}, where m is a natural number, X is one of a hydrogen atom, a heavy hydrogen atom, or a halogen group, and n is a natural number;

forming on the under cladding layer a layer of the mixture by spin coating at about 1000 rpm;

irradiating the layer of the mixture either with light through a mask or directly with condensed light, to form a latent image in pattern form which includes irradiated areas and non-irradiated areas;

removing the layer of the mixture in the non-irradiated areas with a solvent to form a pattern, for use as a core portion, for passage of light; and

forming an upper cladding layer on the core portion and an upper portion in the surroundings thereof.

Polymeric materials have a great advantage in that a film can be more readily formed in comparison with glass materials, for example, by spin coating which has the great advantage of forming a film having a uniform thickness in a simple process.

In order to make a multi-mode optical waveguide, a film should have thickness of no less than 50 μm. To meet this requirement, the film-forming material being spin coated should have a viscosity of no less than 500 cps when the spinning rate is about 1000 rpm (i.e., the general rate for spin coating). On the other hand, in order to ensure uniformity of the film, the film-forming material being spin coated should have a viscosity of no more than 10,000 cps.

Applicants discovered that the viscosity of the mixture can be controlled by varying the content of the reactive oligomer of the general formula (I). That is, 10 wt.% of the reactive oligomer in the mixture gives a viscosity of 500 cps and 50 wt.% of the reactive oligomer in the mixture gives a viscosity of 10,000 cps. When these viscosity conditions are employed, a core

portion having a steep and smooth side wall can be obtained by spin coating of the mixture containing the reactive oligomer (I), curing the film by exposure to light, and developing with a solvent.

Tsukamoto et al. describes a tenth embodiment of in which a core portion of an optical waveguide having a rectangular cross section is formed by photolithography. However, Applicants respectfully direct the Examiner's attention to the fact that EHPE-3150, which resembles Applicants' general formula (I), is not used in this embodiment.

It is in the eleventh embodiment of Tsukamoto et al. that EHPE-3150 is used and a core portion of the optical waveguide is formed by a change in refractive index of an exposed part, but not by photolithography. However, Tsukamoto et al. are silent regarding whether photolithography can be employed with EHPE-3150 or not so that Applicants submit that there is no specific teaching that a core portion may be formed by applying photolithography to EHPE-3150. Tsukamoto et al. employ EHPE-3150 in the 17th, 23rd and 30th embodiments, however, in each of these embodiments a core portion is formed by a change in refractive index of an exposed part.

Since photolithography is not specifically applied by Tsukamoto et al. to EHPE-3150, Applicants respectfully disagree with the Examiner's assertion that it would have been obvious from the eleventh embodiment of Tsukamoto et al. to use EHPE-3150 for one of the core materials and to apply photolithography to form an optical waveguide. The Examiner has given no line of reasoning in support of such an assertion.

In view of the foregoing amendments and remarks, it is requested that the rejections of record be reconsidered and withdrawn, that claims 9 and 11 as amended be allowed, and that the Application be found to be in allowable condition.

Should the Examiner not find the Application to be in allowable condition or believe that a conference would be of value in expediting the prosecution of the Application, Applicants request that the Examiner telephone undersigned Counsel to discuss the case and afford Applicants an opportunity to submit any Supplemental Amendment that might advance prosecution and place the Application in allowable condition.

Respectfully submitted,

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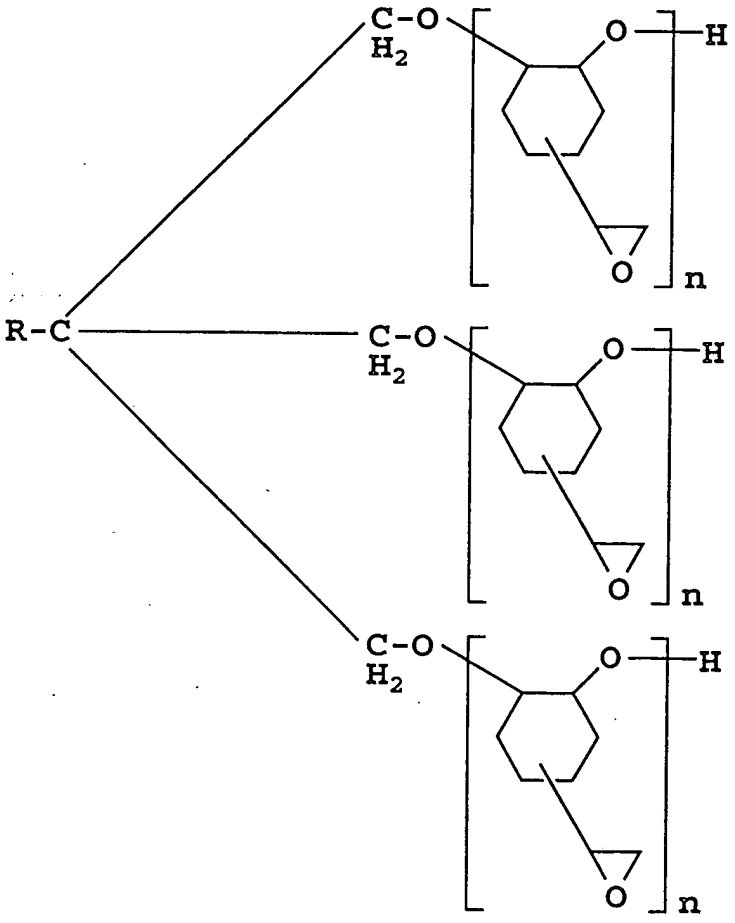
MARKED-UP COPY OF CLAIMS 9 AND 11 AS AMENDED:

9. (Once amended) A method for producing [an] a multi-mode optical waveguide comprised of at least one core and a cladding having a refractive index which is lower than that of the at least one core, the method comprising the steps of:

forming an under cladding layer onto a substrate;

preparing a mixture containing a reactive oligomer having general formula (I) and a photopolymerization initiator by blending, and controlling viscosity of the mixture to provide a viscosity mixture ranging from 500 cps to 10,000 cps by blending the reactive oligomer in an amount ranging from 10 to 50 wt %,



(I)

where R is $[C_mX_{am+1}]$ $\underline{C_mX_{2m+1}}$, where m is a natural number, X is one of a hydrogen atom, a heavy hydrogen atom, or a halogen group, and n is a natural number;

forming on the under cladding layer a layer of the mixture by spin coating at about 1000 rpm;

irradiating the layer of the mixture either with light through a mask or directly with condensed light, to form a latent image in pattern form which includes irradiated areas and non-irradiated areas;

removing the layer of the mixture in the non-irradiated areas with a solvent to form a pattern, for use as a core portion, for passage of light; and

forming an upper cladding layer on the core portion and an upper portion in the surroundings thereof.

11. (Once amended) The method according to claim 9 [10], wherein the reactive oligomer having general formula (I) has a value for n which is five.